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The Influence of Spray Programs on the Fauna of Apple Orchards in Nova Scotia. III. Mites and their Predators[1]

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(*Continued from August issue*)

Hemiptera

Miridae

Three mirids, *Diaphnidia pellucida* Uhler, *Hyaliodes harti* Knight, and *Campylomma verbasci* (Meyer), are effective predators of the red mite and probably of the clover mite from early in June until the latter part of July. These three species are the only important predacious mirids under the conditions of the present spray practices in Nova Scotia. Gilliatt (2) has given an account of the life-histories of the three species and discussed their importance in the natural control of the red mite, and his account need not be repeated here. The three mirids are often the only important predacious species in many commercial orchards during the summer months because of the destruction of *I. tiliae* and *H. faurei* by the sulphur sprays employed around the bloom period. Their presence in such orchards is in itself evidence that neither bordeaux mixture nor flotation sulphur reduces their numbers. Observation on a considerable number of occasions showed that iron carbamate has no effect on these mirids. An opportunity to test some of the common spray chemicals on two of the species was presented in the F. Palmer orchard at Berwick in 1947. Two trees were sprayed with each of the materials listed, and the insects were collected as they dropped on two trays, of 32 square feet each, which had been placed beneath the trees.

The results (Tables XI and XII) are an indication only; probably the actual mortalities were higher, as many of the insects recorded as "alive" two hours after the application were affected by the spray and it is likely that ants removed some of the dead mirids from the trays during the twenty hours preceding the final count.

Diaphnidia provancheri (Burque) feeds readily on the red mite and on a few occasions has been found in considerable numbers in midsummer. *Diaphnidia capitata* Van Duzee was recorded by Gilliatt (2) as a predator of the red mite, but during the past five years it has not been observed by the writer in anything but insignificant numbers. *Deraeocoris nebulosus* (Uhler) sometimes appears in moderate numbers but in no case was observed to play more than a minor role in the natural control of the red mite. *Deraeocoris fasciolus* Knight was found mainly in association with clusters of the rosy apple aphid, *Anuraphis roseus* Baker, but in the laboratory it fed readily on red mite eggs. *Criocoris saliens* (Reuter) occurs only in small numbers, so that it appears to be of little importance even though it consumed red mites and red mite eggs in the laboratory. *Plagiognathus obscurus* Uhler shows no preference for red mite as a prey but will, upon occasion, feed on these mites. *Pilophorus perplexus* Douglas and Scott was numerous in the South Sawler orchard, which has been treated with all-copper sprays since 1945. In this orchard *P. perplexus* appears to have played

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TABLE XI

Number of living and dead D. PELLUCIDA *collected on 64 sq. ft. of cheesecloth trays per plot in the F. Palmer orchard, Berwick, N.S.*

Materials per 100 gal.	After 2 hours				After 20 hours			
	nymphs		adults		nymphs		adults	
	alive	dead	alive	dead	alive	dead	alive	dead
Synthetic cryolite, 3 lb.	2	1	0	0	1	3	0	0
DDT, 2 lb. (50%)	12	4	4	2	63	173	0	22
Fixed nicotine,* 4 lb.	9	33	9	17	52	81	12	36
Summer oil, 1 gal.	10	9	10	2	4	38	7	13

*Black Leaf 155.

TABLE XII

Number of living and dead H. HARTI *adults on 64 sq. ft. of cheesecloth trays per plot in the F. Palmer orchard, Berwick, N.S.*

Materials per 100 gal.	After 2 hours		After 20 hours	
	alive	dead	alive	dead
Synthetic cryolite, 3 lb.	1	0	0	0
DDT, 2 lb. (50%)	0	0	8	22
Fixed nicotine,* 4 lb.	9	4	2	18
Summer oil, 1 gal.	2	1	3	4

*Black Leaf 155.

an important part in the natural control of the clover mite; it also fed upon the red mite and its eggs in the laboratory. This mirid has not been found in sulphur-sprayed orchards, and a single application of flotation sulphur on two trees in the South Sawler orchard greatly reduced its numbers.

None of the mirid species except the three specified can be regarded singly as of great economic importance in the control of the red mite under present conditions of spraying although all of those discussed feed on it and, in the laboratory, most of them fed readily on the clover mite. Too little is known of the effect of the spray materials upon the less important species to warrant any conclusions.

C. verbasci, commonly known as the mullein leaf bug, although an important factor in the control of the red mite, will, upon occasion and for reasons as yet unknown, attack the apples. A detailed description of the damage attributed to this species was given by Pickett (7), and a report on experiments on its

control was presented by Pickett *et al.* (8). The belief was expressed in the latter paper that the failure to obtain complete control with pyrethrum and nicotine sulphate was correlated with the difficulty of reaching all hiding places of the nymphs. The relatively large numbers of *C. verbasci*, so often found associated with a high density of red mites, has not been coexistent with severe damage to the fruit in the observations made during the past five years. This species at least balances its economic damage with the benefits it gives in the control of the red mite.

ANTHOCORIDAE

Two species, *Orius insidiosus* (Say) and *Anthocoris musculus* (Say), are fairly important predators when numerous enough, but they usually contribute only in a minor way to the control of the red mite in Nova Scotia. They are among the earliest predators to infiltrate in the fall into orchards which have been treated with DDT, but no specific information is available as to the effect of other spray materials upon their density.

Coleoptera

The only beetle that appears to be at all important in the control of the red mite is a coccinellid, *Scymmus* sp., and it has been of relatively minor importance as it is seldom found in large numbers. In the fall of 1948 the adults were more numerous in some orchards than in any previous year of these studies, but even in these instances they were not judged to be the dominant factor in the natural control of the red mite. Gilliatt (2) found *Stethorus punctum* (Lec.) to be important in a few orchards in 1932 and 1933, but this species does not appear to be prevalent now. The adults of a number of other species of Coccinellidae were captured and placed with red mites in the laboratory. The species which fed upon red mites were: *Adalia frigida* (Schn.), *Adalia bipunctata* (L.), *Cleis* sp., *Anatis quindecimpunctata* (Oliv.), *Coccinella transversoguttata quinquenotata* Kby., *Coccinella nivicola monticola* Muls., *Coccinella trifasciata perplexa* Muls., *Anisocalvia quatordecimguttata* (L.), [=*Anisocalvia obliqua* Rand], *Anisocalvia duodecim-maculata* (Gebl.), and *Psyllobora viginti-maculata* (Say).

Neuroptera

Several species of unidentified Chrysopidae are often important in the autumn months, contributing considerably in some cases to the destruction of the overwintering eggs of the red mite. These species are often the first important predators to appear in blocks of orchards which have been treated with DDT, but very little is known of their biology or of the effects of the spray materials upon them.

A species of Coniopterygidae, *Conwentzia* sp. (probably *hageni* Banks), has been observed each fall feeding upon the overwintering eggs of the red mite. This species has not been numerous enough during the period covered by these studies to affect appreciably the population of red mites. In the fall of 1948, however, it was much more numerous than usual, but in no instance were the numbers sufficient to classify it as a major factor in the control of the red mite.

Diptera

Several unidentified species of syrphid larvae and another which appeared to be a cecidomyiid larva will feed upon small, quiescent mites and possibly the eggs of the red mite. They are of little economic importance and nothing is known concerning the effect of sprays upon them. The cecidomyiid larvae were noticed on several occasions feeding upon eriophyid mites.

RESULTS OF OBSERVATIONS IN EXPERIMENTAL ORCHARDS

Hiltz-South Yarmouth Orchard

These two adjacent and aligned blocks of about five acres each, although under separate management, have been the basis of a long-term experiment since 1943, to compare the influence of copper and sulphur fungicides on the orchard fauna. Prior to the initiation of the spray programs now in use, the two orchards had a different history of treatment, about which a few words are pertinent. In 1942 the Hiltz block received the full quota of bordeaux and flotation sulphur fungicides and in addition three extra cover sprays of lead arsenate and synthetic cryolite, including summer oil for the control of the codling moth, *Carpocapsa pomonella* (L.). In the same year (1942) the South Yarmouth orchard was left unsprayed during a change of ownership. In 1943 each of these blocks was divided into north and south halves for experimental treatments. Since 1943, the south half of each orchard has received six applications of flotation sulphur each year, with the exception of a delayed dormant application of lime-sulphur in 1943 and 1944. The north portion of each orchard has received all-copper (bordeaux and fixed copper[1]) sprays; and over the whole area lead arsenate has been used in combination with the fungicides. In addition, the whole orchard has each year received extra cover sprays of lead arsenate and synthetic cryolite for the control of the codling moth.

The experiment, therefore, consists basically of a comparison of copper and sulphur fungicides; and for convenience, the plots will be designated in the following paragraphs as the copper plot and the sulphur plot. The continued treatment with copper and sulphur sprays has created marked differences in the mite fauna of the two plots, but the differences in the density of the European red mite populations has been most striking. On the copper plot the red mite had dropped to a low population level by 1944 and has remained of minor importance, but on the sulphur plot the mite has been an acute economic pest each year (Table XIII). The contrast in the bronzing of the foliage on the two plots each summer has been evident even from a considerable distance. In 1947, during the bloom period, the numbers of trees in full bloom were sharply marked off along the line separating the two plots, with only a scattering of blossoms on the sulphur plot. The dry season of 1946, combined with the damage to the foliage by the red mite by mid-July, had very evidently prevented the formation of fruit buds on the sulphur plot. Possibly similar damage to the foliage in 1944 and 1945 had also contributed to the weakening of the trees with the cumulative effect showing as a loss in the crop in 1947. A similar reduction of the crop in the year following severe damage to the foliage by the red mite has been observed in several other orchards.

A careful check upon the predacious species of mites and insects in these two plots has shown that the differences in the population of red mites were due to differences in the effects of the sprays on the natural enemies. The materials used have had no toxic effect on the red mite, but sulphur has been detrimental to a number of predacious species. The only predators found on the sulphur plots in appreciable numbers during early- to mid-summer were the three mirids, *C. verbasci*, *D. pellucida*, and *H. harti*. The predacious thrips *H. faurei* has been scarce during the spraying season but has been abundant in September and October. *I. tiliae*, a predacious mite which can be one of the most important natural enemies of the red mite, was destroyed by the sulphur sprays. The three mirids, though relatively abundant, were unable to stop the increase of the red mite on the sulphur plot, nor was heavy predation of the winter eggs by the thrips

[1]Copper oxychloride sulphate.

sufficient to prevent a rapid increase of the red mite the following spring. The natural enemies of the red mite effected an efficient and continuing control in the copper plot, since copper sprays had no effect on the predators. In addition, the predacious thrips *Z. minutus* was also observed in small numbers in the copper plot. Unfortunately, no records were taken of mites in 1943, the first year of this long-term experiment. In several commercial orchards in which a change was made from a bordeaux-flotation sulphur program to one of all-copper sprays there was a rapid increase in the numbers of *I. tiliae* during the summer in which the change was made. In these instances, as the density of the red mite population decreased from predation by *I. tiliae* and other predators during the second year of treatment, the predators also became scarcer. It may be assumed, therefore, that in the copper block of this experiment a similar sequence of biological changes took place in the first and second years and that the relatively small numbers of *I. tiliae* in later years were related to the low density of the red mite population in the plot.

The clover mite is destroyed by the sulphur sprays, as is illustrated in Table XIII, which shows that only a trace of this species has been found on the sulphur plot. On the copper plot, however, it has been the most prevalent mite. Though this mite has been moderately numerous, it has caused only minor damage to the foliage. Some varieties such as Wagener showed a fair amount of bronzing of the foliage on the inner parts of the trees. An important predacious mite, *M. novae-scotiae*, has exerted considerable natural control, but *H. faurei* and the mirids have also contributed to the economic control of the clover mite. After gradually increasing from 1944 to 1947, the clover mite decreased in 1948, and in view of the innocuous nature of copper sprays to the predacious species it seems unlikely that it could ever become a serious pest on the copper-treated plot.

The numbers of *M. novae-scotiae* (Table XIIF) show that copper sprays have little or no effect on this mite. The lack of *M. novae-scotiae* in the sulphur plot may be due to the sulphur sprays, but this has not been established and it may simply be due to the lack of clover mite eggs. A point of interest, however, is that *M. novae-scotiae* feeds on eriophyids, which are often numerous in the sulphur plot in the late summer. *M. novae-scotiae* has seldom been found in the sulphur plot even under such circumstances, indicating that it is controlled by sulphur sprays.

Other mites, such as unidentified, free-living species of *Eriophyiidae*, have been found in moderate numbers in the copper plot but have usually disappeared quickly, apparently from attack chiefly by *I. tiliae* and *M. novae-scotiae*. Sulphur appears to keep the eriophyids in check although they have on some occasions been observed in large numbers on the sulphur plot in August, when the residual sulphur on the tree had apparently been dissipated by weathering.

Mites of the family Tydeidae, particularly *Tydeus robustus* Banks; other bark-inhabiting species; and *Hemisarcoptes malus* (Shimer), a mite predacious on the oystershell scale, were much more common on the copper plot.

An unidentified species of *Tarsonemus* of no known importance has been found in small numbers in both plots. This mite has often been seen on the foliage but is more commonly found on the bark.

Aldershot Orchards

A description of these orchards was given in a previous paper in this series (9) and need not be recapitulated here except to point out that the orchards were not sprayed and received no cultural treatment for five years prior to the

TABLE XIII

Hilts-South Yarmouth Orchard

Mites and mite eggs on Baldwin leaves from trees sprayed with copper and sulphur fungicides with lead arsenate as the insecticide.

Year	Species	COPPER					SULPHUR				
		Total mites and eggs per 100 leaves in the early part of				Average healthy eggs per twig axil in winter	Total mites and eggs per 100 leaves in the early part of				Average healthy eggs per twig axil in winter
		June	July	August	Sept.		June	July	August	Sept.	
1944	*M. ulmi*	–	458	1619	71	0	3364	1656	17053	2980	3
1945	" "	0	1	9	1	0	15	56	6478	6753	89
1946	" "	7	52	201	39	2	13219	12657	16656	2156	22
1947	" "	7	17	2614	987	3	644	1769	30890	—	37
1948	" "	3	155	1695	2675	7	115	588	11133	—	154
1944	*I. tiliae*	4	4	62	19		0	0	0	0	
1945	" "	2	3	15	8		0	0	1	46	
1946	" "	3	8	9	16		1	0	0	2	
1947	" "	0	7	115	46		0	0	0	1	
1948	" "	1	2	8	14		0	0	0	0	
1944	*B. praetiosa*	—	789	258	69	2	0	0	0	0	0
1945	" "	42	957	425	64	9	0	0	0	0	0
1946	" "	300	2140	2288	800	15	0	1	1	0	0
1947	" "	30	648	4053	—	18	2	0	0	—	0
1948	" "	38	1597	2525	3345	22	0	0	0	0	0
1944	*M. novae-scotiae*	1	3	227	408		0	0	5	0	
1945	" "	78	244	992	386		0	0	16	77	
1946	" "	103	207	1875	1126		0	0	0	6	
1947	" "	23	38	618	477		0	0	0	0	
1948	" "	10	19	206	1100		0	0	0	0	

initiation of the present experiment in 1945. The variety Ben Davis is predominant in these orchards and is the only variety common to all blocks; for this reason the records were based on this variety.

(a) North Sawler Orchard

The west half of this orchard has received annually six applications of iron carbamate without an insecticide, and the east half has received the same treatment with the addition of lead arsenate in the post-blossom sprays.

The small numbers of red mites in both plots in this orchard are not comparable to the general picture in most commercial orchards where a bordeaux-iron carbamate fungicide program has been followed. In all the Aldershot orchards the five-year period of neglect before 1945 had allowed the natural control agencies to reduce the populations of red mite and clover mite to very low levels, as is characteristic of neglected orchards in Nova Scotia. The increase in the red mite population in 1948, particularly where the arsenical was used, suggests that the density of the red mite population is rising to the level more characteristic of commercial orchards. In other words, the rather low populations of the red mite may be partly a question of time and partly an effect of the natural resistance of Ben Davis to attacks by the red mite.

The iron carbamate has destroyed *I. tiliae* although most of the other species that prey upon the red mite have been found in small and variable numbers since 1945. The greater numbers of red mites (Table XIV) where lead arsenate was

used with the iron carbamate suggest the probability that lead arsenate was an added lethal factor against one or more of its natural enemies.

The differences in the populations of the clover mite in these two plots (Table XIV) indicate that lead arsenate is detrimental to some factor or factors in the complex of natural control agents. The absence or small numbers of *M. novae-scotiae* in all cases where iron carbamate has been used is taken as strong evidence that iron carbamate is very detrimental to it. The very small numbers found on these iron carbamate plots was a contributing factor to the general build-up of the clover mite that has gradually taken place. The fact that greater numbers of the clover mite are associated with the scarcity of the predacious mite *A. agilis* at the end of the orchard treated with the lead arsenate lends weight to the belief that the destruction of *A. agilis* by the arsenical was a contributing factor to the higher numbers of the clover mite in that plot.

(b) Boyle Orchard

This block received a dormant application of sodium dinitro-o-cresylate in the springs of 1945, 1946, and 1948, but not in 1947. The dormant spray has been followed each year by six applications of iron carbamate with no added insecticide. In Table XIV the mite populations since 1945 on this block are compared with the populations on the plots treated with iron carbamate alone and with the addition of lead arsenate.

The applications of sodium dinitro-o-cresylate in the dormant period allowed some predacious species to escape its adverse effects. The toxic qualities of this material against a number of predators, and the destruction of the predacious mites *I. tiliae* and *M. novae-scotiae* by iron carbamate brought about a greater increase in red mites than in the other iron carbamate plots in the Aldershot orchards.

TABLE XIV

Aldershot Orchards

Mites and mite eggs on Ben Davis leaves from trees in the North Sawler plots of iron carbamate alone and with lead arsenate and from the Boyle plot of iron carbamate with dormant treatments of sodium dinitro-o-cresylate.

Year	Species	Iron carbamate					Iron carbamate plus lead arsenate					Iron carbamate plus dormant DNC[1]				
		Total mites and eggs per 100 leaves in the early part of				Avg. healthy eggs per twig axil in winter	Total mites and eggs per 100 leaves in the early part of				Avg. healthy eggs per twig axil in winter	Total mites and eggs per 100 leaves in the early part of				Avg. healthy eggs per twig axil in winter
		June	July	Aug.	Sept.		June	July	Aug.	Sept.		June	July	Aug.	Sept.	
1945	*M. ulmi*	3	7	–	16	0	13	4	–	23	0	0	0	–	4	0
1946	" "	10	15	44	–	1	0	10	1	–	1	0	0	1	–	1
1947	" "	10	–	10	12	1	31	–	106	246	1	51	–	3755	3750	11
1948	" "	–	0	22	62	3	–	9	139	663	8	–	340	798	6025	27
1945	*I. tiliae*	2	1	–	4		3	0	–	2		0	0	–	1	
1946	" "	0	0	1	–		0	0	9	–		0	0	0	–	
1947	" "	0	–	7	24		0	–	1	14		0	–	1	0	
1948	" "	–	0	0	2		–	0	1	1		–	0	0	0	
1945	*B. praetiosa*	1	16	–	115	1	6	18	–	225	1	0	0	–	2	0
1946	" "	15	172	147	–	2	13	471	431	–	5	0	0	17	–	0
1947	" "	2	–	269	168	2	6	–	1340	269	12	4	–	489	359	3
1948	" "	–	9	80	236	4	–	35	360	2012	13	–	2	42	165	1
1945	*M. novae-scotiae*	0	0	–	0		0	0	–	0		0	0	–	0	
1946	" "	0	0	0	–		0	0	0	–		0	0	0	–	
1947	" "	0	–	0	2		0	–	0	6		0	–	7	0	
1948	" "	–	0	0	0		–	0	0	1		–	0	0	0	

[1]DNC — Sodium dinitro-o-cresylate as a dormant treatment in 1945, 1946, and 1948, but not in 1947.

(c) Centre Sawler Orchard

This orchard has received six applications of flotation sulphur each year since 1945. The red mite was at a very low population level following the five years of neglect, but its rapid rise to large numbers since sulphur was first applied has been sensational (Table XV). Although the variety Ben Davis offers considerable resistance to the red mite, the numbers of this mite were great enough in 1948 to bronze the foliage severely. The extreme scarcity of *I. tiliae*, which is destroyed by sulphur, caused a very notable lessening in the environmental resistance to the red mite. Table X shows that *H. faurei* was not plentiful in this block, and, as in the Hiltz-South Yarmouth orchard, was much scarcer during the spraying season than later in the fall. This scarcity was a result of the use of sulphur sprays. The predacious mirids, which are unaffected by sulphur, have also been present in numbers too small to stop the increase in the red mite. The clover mite was destroyed by the sulphur sprays as in the sulphur plot of the Hiltz-South Yarmouth orchard (Table XIII). The two predacious mites *M. novae-scotiae* (Table XV) and *A. agilis* (Tables VI and VII) appear to have been destroyed by the sulphur sprays, but there is the possibility, yet to be investigated, that suitable prey were not present to attract these species.

(d) South Sawler Orchard

This block started with the same low population of mites as the other blocks, and four years of treatment with copper sprays (bordeaux and fixed copper) has not greatly changed their numerical relationships, as is shown in Table XV. A comparison with Table XIII will show much the same relations as for the Hiltz-South Yarmouth copper plot except for the actual numbers of

TABLE XV

Aldershot Orchards

Mites and mite eggs on Ben Davis leaves from trees in the Centre Sawler plot of flotation sulphur alone and from the South Sawler plot of copper sprays.

Year	Species	SULPHUR					COPPER				
		Total mites and eggs per 100 leaves in the early part of				Average healthy eggs per twig axil in winter	Total mites and eggs per 100 leaves in the early part of				Average healthy eggs per twig axil in winter
		June	July	Aug.	Sept.		June	July	Aug.	Sept.	
1945	*M. ulmi*	0	0	–	5	3	1	0	–	0	0
1946	" "	17	127	620	–	6	0	1	0	–	1
1947	" "	523	–	12010	7493	22	0	–	8	5	0
1948	" "	–	491	1360	20065	59	–	0	19	84	1
1945	*I. tiliae*	0	0	–	0		1	7	–	1	
1946	" "	0	0	0	–		0	4	4	–	
1947	" "	0	–	0	0		0	–	21	60	
1948	" "	–	0	0	0		–	0	16	111	
1945	*B. praetiosa*	1	0	–	0	0	3	59	–	132	9
1946	" "	0	0	0	–	0	24	130	476	–	5
1947	" "	8	–	0	5	0	36	–	939	99	5
1948	" "	–	0	4	0	0	–	20	411	538	2
1945	*M. novae-*	0	0	–	0		0	0	–	0	
1946	*scotiae*	0	0	0	–		0	0	0	–	
1947	" "	0	–	0	0		1	–	4	13	
1948	" "	–	0	0	0		–	0	0	0	

each species. Since no arsenicals have been used in this orchard, *A. agilis* has been present in variable numbers, and the same is true of *H. faurei*. Mirids in general have been scarce but most of the species listed in the previous section on the predators of mites have been observed. One in particular, *Pilophorus perplexus*, has been rather numerous and has contributed considerably to the control of mites in this block.

Sutton Orchard

Although this block was a small orchard sprayed by the owner, a discussion of it has been included, since it is an excellent example of the variable effects of a bordeaux-iron carbamate program and is more typical of the average results than the Aldershot orchards. In the spring of 1944 this block had been treated with an application of 5 per cent dormant oil to control the oystershell scale. This was followed by sprays of bordeaux and flotation sulphur with lead arsenate as the insecticide during 1944. From 1945 to 1948 the orchard was sprayed with bordeaux and iron carbamate with lead arsenate as the insecticide. The dormant oil in 1944 had greatly reduced the red mite population and in 1945 there were still only a few mites. In 1946 both the red mite and the clover mite built up rapidly to numbers sufficient to cause considerable bronzing of the foliage. In 1946 predacious mirids and thrips were not plentiful during the summer, and *I. tiliae*, as is shown in Table XVI, was repressed during the period when the iron carbamate was on the trees. *I. tiliae* was more numerous in this orchard than is usual where iron carbamate is used. It will be noted, however, that it became numerous in the fall of 1945, was repressed in June of 1946 during the period the iron carbamate was on the foliage, and became plentiful again in the fall of 1946. *H. faurei* became very common in the fall of 1946 and was very numerous in the summer of 1947 (Table VIII). During 1947 this thrips was the most important natural enemy of the phytophagous mites in this orchard, reducing both the clover mite and the red mite to low population levels by the fall of the year. In 1948 the mites and the predacious thrips were both scarce during the summer and by autumn there were more mite eggs in the twig axils than in 1947.

The differences between the mite populations in the North Sawler orchard and in this block of orchard were due to former spray treatments, to differences in susceptibility of the varieties to mite attack, and to the greater number of iron carbamate applications in the North Sawler orchard.

Tobin Orchard

This small block of King and Starking trees was treated in 1947 and 1948 by the owner with bordeaux and iron carbamate fungicides, nicotine sulphate being incorporated in the last four sprays of a six-application program. In 1946 the same fungicide program had been used with lead arsenate as the insecticide, and previous to 1946 the orchard had been treated with bordeaux and flotation sulphur. In 1946 the red mite was very numerous and had severely bronzed the Starking foliage, but by fall the predacious thrips *H. faurei* had become plentiful. In the spring and summer of 1947 this thrips was very numerous (Table VIII) and was the only predator at all numerous in this block. Though there is some evidence from single-tree experiments that nicotine sulphate will under some circumstances destroy this thrips, it was able to survive in this orchard in sufficient numbers to be able practically alone to reduce the heavy population of red mites. In Table XVII the results of some counts of mites on the leaves are given and these show the usual scarcity of *I. tiliae* and *M. novae-scotiae*.

TABLE XVI

Sutton orchard

Mites and mite eggs per 100 leaves on trees sprayed with bordeaux and iron carbamate fungicides with lead arsenate as the insecticide. (Leaves from mixed varieties in 1945 and 1946 and Ribston Pippin in 1947 and 1948).

Year	Date	Red mites and eggs	Clover mites and eggs	*I. tiliae* and eggs
1945	July 19	67	25	2
	Aug. 24	514	129	82
1946	June 6	41	30	154
	June 14	424	323	79
	June 19	276	465	25
	June 26	—	—	33
	July 8	988	1471	11
	July 16	5416	2200	31
	July 24	3845	5253	44
	Aug. 5	11440	3716	46
	Aug. 16	16575	5330	129
	Sept. 3	4878	3615	299
	Sept. 17	2265	3378	256
1947	July 11	3762	948	46
	Sept. 5	298	162	78

Average viable mite eggs overwintering per twig axil.

Year	European red mite	Clover mite
1945	4	5
1946	21	32
1947	1	3
1948	7	22

Palmer Orchard

Five rows in this orchard have been treated with six applications of iron carbamate and lead arsenate since 1944, and of these five rows, two had also been treated in 1943 with the same fungicide. This was part of an experiment on the natural control of the oystershell scale presented in a previous paper (3), but the results with mites are of value to contrast with the results from the North Sawler orchard, which has also had six applications of iron carbamate each year. The variable numbers of the red mite shown in Table XVIII, sometimes large and sometimes small, are typical of the commercial use of iron carbamate, but increased pressure has been exerted upon *I. tiliae* in this instance by the full program of iron carbamate. For some unknown reason the clover mite has not become even a minor pest in this orchard, and therefore the apparent repression of *M. novae-scotiae* cannot be attributed to the iron carbamate alone in this case.

Wolfe Orchard

Previous to 1944 this block had not been sprayed for about 15 years and was in a state of extreme neglect. From 1944 to 1946, 40 trees were fertilized and sprayed with iron carbamate. No lengthy discussion of the results given in

TABLE XVII

Tobin Orchard

Mites and mite eggs on Starking leaves from trees sprayed with bordeaux and iron carbamate fungicides with nicotine sulphate as the insectide.

Year	Species	Total mites and eggs per 100 leaves in the early part of				Average healthy eggs per twig axil in winter
		June	July	August	September	
1946	*M. ulmi*	–	–	Heavy	Heavy	78
1947	" "	–	2150	9796	38	12
1948	" "	6	–	34	3731	27
1946	*I. tiliae*	–	–	–	–	
1947	" "	–	0	36	0	
1948	" "	0	–	0	0	
1946	*B. praetiosa*	–	–	–	–	Trace
1947	" "	–	36	40	2	1.3
1948	" "	0	–	6	6	Trace
1946	*M. novae-scotiae*	–	–	–	–	
1947	" "	–	0	48	0	
1948	" "	0	–	0	0	

TABLE XVIII

Palmer Orchard

Mites and mite eggs on Cox Orange leaves from trees sprayed with iron carbamate and lead arsenate.

Year	Species	Total mites and eggs per 100 leaves in the early part of				Average healthy eggs per twig axil in winter
		June	July	August	Sept.	
1944	*M. ulmi*	7190	2167	16978	—	3
1945	" "	132	122	—	7954	36
1946	" "	2854	2780	4524	6672	9
1947	" "	—	—	5262	164	3
1944	*I. tiliae*	0	0	2	—	
1945	" "	0	0	—	164	
1946	" "	2	0	0	0	
1947	" "	—	—	26	16	
1944	*B. praetiosa*	1	0	0	—	0
1945	" "	0	0	—	0	0
1946	" "	0	0	0	0	0
1947	" "	—	—	0	0	0
1944	*M. novae-scotiae*	0	0	4	—	
1945	" "	0	0	—	0	
1946	" "	0	0	0	0	
1947	" "	—	—	2	48	

Table XIX is needed but the trends showing in that short period are of interest. The mite counts were made on more susceptible varieties than in the North Sawler orchard and the rise in the mite population was slightly more pronounced. The scarcity of *I. tiliae* and *M. novae-scotiae* in the presence of increasing

numbers of red mite and of clover mite is additional evidence of the detrimental effects of iron carbamate on these two predacious mites. The increase in the phytophagous species would have been even more rapid but for the presence of a number of other predators which were not influenced by the iron carbamate.

TABLE XIX
Wolfe Orchard
Mites and mite eggs on (mixed) Blenheim, Stark, and Northern Spy leaves from trees sprayed with iron carbamate.

Year	Species	Total mites and eggs per 100 leaves in the early part of:			
		June	July	August	September
1944	*M. ulmi*	—	—	295	—
1945	" "	6	48	562	—
1946	" "	10	130	335	626
1944	*I. tiliae*	—	—	14	—
1945	" "	2	22	4	—
1949	" "	6	0	0	16
1944	*B. praetiosa*	—	—	132	—
1945	" "	6	308	155	—
1946	" "	6	75	180	30
1944	*M. novae-scotiae*	—	—	3	—
1945	" "	2	2	0	—
1946	" "	0	0	0	0

Discussion

The investigation of the basis for a widespread outbreak of the oystershell scale in Nova Scotia, presented in a previous paper (3), had shown that the problem had arisen from the manner in which sulphur sprays interfered with the effective functioning of the natural enemies of the scale. The copper fungicides (bordeaux and fixed copper) and iron carbamate were shown to have no adverse influence on the predacious mite *H. malus* or on the parasite *Aphelinus mytilaspidis* LeB. In a number of orchards in which the oystershell scale was a problem, the growers have been following the practice of using a fungicide program of bordeaux and iron carbamate during the past several years. In these orchards the iron carbamate has been applied in the bloom-period sprays and bordeaux in the rest of the applications. The results of this practice have been satisfactory with respect to the finish of the fruit, in the control of apple scab, and in the decimation of the oystershell scale by its natural enemies. The substitution of iron carbamate for sulphur in the bloom-period applications has, however, been much less consistently satisfactory in promoting the natural control of the European red mite than was the case with the oystershell scale and its natural enemies. In the few instances in which all-copper fungicides have been used in commercial orchards and experimental plots, the red mite has become of minor importance after the first year, and has thereafter remained consistently low as a result of effective predation by its natural enemies. In each instance in which all-copper fungicides have been employed, the predacious mite *I. tiliae* has been one of the most important natural agencies in the control of the red mite. Those

spray materials studied which are not detrimental to *I. tiliae* also appear to have little influence on the other species of predators, and consequently *I. tiliae* is usually only one of a complex of natural enemies of the red mite in the orchard. The species other than *I. tiliae* which are capable of effective predation on the red mite are much more sporadic in occurrence, and where *I. tiliae* is destroyed by a spray, the density of the red mite population is often dangerously high. Iron carbamate destroys *I. tiliae* but has no detrimental effect on the predacious thrips *H. faurei*, whereas sulphur destroys both of these species during the period in which the trees are coated with spray residue. This differential effect of sulphur and iron carbamate on *H. faurei*, together with the great natural variation in the numbers of *H. faurei* and of the other effective predators such as Miridae (which are not influenced by either material), has predicated a variable red mite problem on the economic level from the use of these materials. In commercially sprayed orchards a severe outbreak of the red mite may occur where either iron carbamate or elemental sulphur is used, but natural enemies appear to have a greater chance of reducing the red mite population in orchards sprayed with iron carbamate.

The clover mite is a potential pest of apple trees and may acquire a minor economic importance in orchards treated with all-copper fungicides. This mite is destroyed by sulphur applications, so that it is never a pest in commercial orchards in which sulphur fungicides are used. Iron carbamate does not destroy the clover mite, and although it destroys *M. novae-scotiae*, an important predator of mites, the clover mite has not become an important pest in commercial orchards in which iron carbamate has been used. The reason for this is not known but the evidence to date suggests that it may be the slower build-up of the clover mite so that less effective predation is needed than for the red mite.

Of the mite species common to long-neglected apple trees, copper fungicides destroy none except the species *Czenspinskia lordi*, which is a fungous feeder; and the action in that case may not be one of direct toxicity. With further work, this broad statement may need modification but there has been no evidence in the studies to date to indicate any direct action on mite species. Iron carbamate is detrimental to more mite species than the copper sprays, but besides those discussed there are a number of species of no known economic importance which escape the adverse influence of iron carbamate. Sulphur sprays are widely detrimental to the Acari of apple trees except several mites of no importance and the European red mite.

For purposes of comparison a tentative rating of the effect of some of the more commonly used spray materials on the species of economic importance is given in the preceding list. The degree of effectiveness and the biological characteristics of the species which may allow some of them to escape or to reinfest an orchard are not shown. Those which appear to be moderately safe from detrimental effects are rated as "S" and those which are adversely influenced are rated as "A". The symbol "vn" indicates that the rating is probably as given but that verification is needed, and a dash indicates that no information is available.

Acknowledgments

The writer is indebted to A. W. MacPhee of the Dominion Entomological Laboratory, Annapolis Royal, N.S., for his kindness in contributing the data presented in Tables II, IV, V, VI, VIII, and X.

Acknowledgment is also made of the generous assistance of Dr. H. H. J. Nesbitt, Professor of Zoology, Carleton College, Ottawa. Dr. Nesbitt has con-

SUMMARY AND TENTATIVE RATING OF THE EFFECT OF SPRAY MATERIALS ON SOME PHYTOPHAGOUS AND PREDACIOUS MITES AND THEIR INSECT PREDATORS.

Species	Copper	Iron carbamate	Elemental sulphur	Summer oil	Fixed nicotine	Nicotine sulphate	Lead arsenate	Synthetic cryolite
M. ulmi	S	S	S	A	S	S	S	S
B. praetiosa	S	S	A	A	S	S	S	S
I. tiliae	S	A	A	A	Svn	Svn	S	S
M. novae-scotiae	S	A	A	—	—	—	S	S
A. agilis	S	S	Avn	—	—	—	A	Svn
H. faurei	S	S	A	Avn	S	S	S	S
L. mali	S	S	—	—	S	S	S	S
Z. minutus	S	—	A	—	—	—	—	—
D. pellucida	S	S	S	A	A	A	S	S
H. harti	S	S	S	—	A	A	S	S
C. verbasci	S	S	S	—	—	A	S	S
P. perplexus	S	—	A	—	—	—	S	—

tributed very materially by supplying identifications of large numbers of specimens of mites throughout the course of these studies.

Appreciation is also extended to all members of the staff of the Dominion Entomological Laboratory, Annapolis Royal, N.S., for suggestions, criticisms, and generous co-operation in the gathering of the data presented in this paper.

Literature Cited

1. Garman, Philip. Mite species from apple trees in Connecticut. *Conn. Agr. Expt. Sta. Bul.* 520. 1948.
2. Gilliatt, F. C. Some predators of the European red mite, *Paratetranychus pilosus* C. & F., in Nova Scotia. *Can. J. Res., D,* 13: 19-38. 1935.
3. Lord, F. T. The influence of spray programs on the fauna of apple orchards in Nova Scotia: II. Oystershell scale, *Lepidosaphes ulmi* (L.). *Can. Ent.* 79: 196-209. 1947.
4. MacPhee, A. W. The bionomics and morphology of the predacious thrips, *Haplothrips faurei* Hood. (unpublished) Thesis, McGill University. 1947.
5. Nesbitt, Herbert H. J. Three new mites from Nova Scotian apple trees. *Can. Ent.* 78: 15-22. 1946.
6. Nesbitt, Herbert H. J. In *Annual Report of the Dominion Entomological Laboratory, Annapolis Royal, N.S., for 1947.* (unpublished; available for consultation on request).
7. Pickett, A. D. The mullein leaf bug, *Campylomma verbasci* Meyer, as a pest of apple in Nova Scotia. 69th *Ann. Rept. Ent. Soc. Ont.*, pp. 105-106. 1938.
8. Pickett, A. D., N. A. Patterson, J. MacB. Cameron, and M. E. Neary. Field experiments for the control of the mullein leaf bug, *Campylomma verbasci* Meyer, in Nova Scotia apple orchards. 71st *Ann. Rept. Ent. Soc. Ont.*, 1940, pp. 23-25. 1941.
9. Pickett, A. D., N. A. Patterson, H. T. Stultz, and F. T. Lord. The influence of spray programs on the fauna of apple orchards in Nova Scotia: I. An appraisal of the problem and a method of approach. *Sci. Agr.* 26 (11): 590-600. 1946.

On the American Species of *Lyperopherus* Mots. (Coleoptera: Carabidae)*

By W. J. Brown
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The following notes are based on the material in the Canadian National Collection and in the collections of the United States National Museum, the Museum of Comparative Zoology, and the Philadelphia Academy of Natural Sciences.

In all of the three American species of *Lyperopherus*, the flattened side margins of the pronotum are gradually widened posteriorly to include the outer of the basal impressions. All are flightless and have the elytra widest slightly behind the middle.

Lyperopherus innuitorum n. sp.

This seems separable from the other American species only by the characters given in the following key. The body is black and shining throughout, but the elytra are sometimes slightly dulled in the female by minute sculpture that is barely evident in the male. The pronotum, on the median line, measures 70 to 72 per cent of the greatest pronotal width, as against 70 to 74 per cent in each of the other species, and there is a shallow, punctiform fovea on each side of the median line just in front of the middle in all but two of the specimens. Such foveae occur rarely in *punctatissimus* (Rand.) but are lacking in *agonus* (Horn). The pronotal disk bears sparse, transverse rugae which are usually feeble although usually distinct, and the base is usually somewhat roughened at the middle. The posterior pronotal angles are no more obtuse than in *punctatissimus*, but they are much more broadly rounded than in that species. The striae and intervals of the elytra are well defined at the extreme base, and the sutural interval, and sometimes the seventh, is entire. Elsewhere the intervals are traceable only because intervals three, five, and seven are more distantly interrupted than the others, and in these only are many of the segments much longer than wide. Each third interval bears usually five, often four, and occasionally six setigerous punctures. In *punctatissimus* this interval bears commonly four, very often three, and rarely two such punctures; the number in *agonus* is usually three or four, sometimes two or five. The punctures are variably placed in all species and often differ greatly in position on the elytra of one specimen.

Holotype: ♂, Kidluit Bay (lat. 69°32′, long. 133°47′), Richards Island, N.W.T., July 24, 1948 (W. J. Brown); No. 5775 in the Canadian National Collection, Ottawa.

Allotype: ♀, same data, July 31.

Paratypes: 5 ♂, 2 ♀, same data, July 24, 25, and 31; 1 ♂, Baker Lake (lat. 64°10′, long. 96°00′), N.W.T., July 23, 1947 (T. N. Freeman); 1 ♀, Coral Harbour (lat. 64°18′, long. 82°46′), Southampton Island, N.W.T., July 5, 1948 (W. J. Cody).

In the male of *innuitorum*, the apical ventral segment bears two distant setigerous punctures (five specimens) or two distant pairs of such punctures (two specimens); the segment usually bears a very feeble, transverse carina at the middle and infrequently is distinctly rugose from the carina to the apex. In the female, the segment bears four equally spaced setigerous punctures in one specimen, two punctures on one side and three on the other in a second specimen, three

*Contribution No. 2626, Division of Entomology, Science Service, Department of Agriculture, Ottawa.

and four punctures in a third, and three and five in the fourth specimen. In the female the segment lacks a carina and discal rugae. In *punctatissimus* these characters are similar, the male having two, the female four, punctures much more constantly than in *innuitorum*. In the male of *agonus*, there is a single puncture on each side, the puncture being double on one side in one of the four specimens. In the female of *agonus*, nine specimens have four subequally but variably spaced punctures, and five have two distant punctures as in the males. In *agonus* the segment is not carinate; it is very feebly rugose apically in the male and most females and is smooth or strongly rugose on the apical third in several females.

L. agonus is truly arctic, as it seems restricted to treeless areas. The type lacks fore legs and is of undetermined sex. It came from the Yukon River according to Horn (1880, Trans. Amer. Ent. Soc. 8: 140). I have seen specimens from Nome, Alaska; from the Caribou Hills at Reindeer Depot, N.W.T.; from Kidluit Bay (60 miles north of Reindeer Depot and the type locality of *innuitorum*) and from the following localities: Langton Bay (in Franklin Bay), N.W.T., and Demarcation Point, Barter Island, Collinson Point, and Konganevik (Camden Bay), Alaska. The specimens from these last five localities have been reported upon by Fall (1919, Rept. Can. Arctic Exped. 3(E): 15), and the localities are roughly 225 miles east and up to 250 miles west of Kidluit Bay. Van Dyke (1924, Nat. Geog. Soc. Contrib. Tech. Pap. 2(1): 8) has reported the species from Labrador and Lake Louise, Alta., as well as from Alaskan localities and the Hudson Bay region. Because he states that the species is sometimes brilliant green or bronze, I believe that he has misidentified specimens.

The type of *punctatissimus* came from the Blue Mountains of Maine according to Randall (1838, Boston J. Nat. Hist., 2: 3). The species has been reported from several localities in New England, from the mountains of northern New York, from Newfoundland, Labrador, Ungava Bay, and Lake Superior, and from Oxford House and York Factory in northeastern Manitoba. We have specimens from Harmon Field, Nfld., and southern Labrador; from Anticosti Island, Gaspé Co., and the Abitibi Region, Que., and from Cochrane, Ont., Churchill, Man., and Great Slave Lake, Norman Wells, and Wrigley, N.W.T. Heyden (1881, Catalog Coleop. Sibirien, p. 36) and others list *punctatissimus* from Siberian localities. Because the species is not known to occur in Europe or in the Arctic and Pacific regions of America, I believe that he is in error.

Key to Species

1. Legs bicolored, the femora red except at their extreme apices, the tibiae and tarsi blackish. Posterior pronotal angles not defined, more broadly rounded than in the other species, the pronotum otherwise as in *innuitorum*. Elytra extremely variable but always much smoother than in the other species; the striae rather feebly to deeply impressed, usually slightly irregular; the intervals flat to rather strongly convex; usually some of the intervals with a few feeble interruptions. Length 9.5 to 10.5 mm. A species of the tundra of the Western Arctic ..... *agonus* (Horn).

   Legs blackish throughout. Elytra very irregularly sculptured, the striae irregular, the intervals variably interrupted or foveate ..... 2.

2. Pronotum with the sides evenly rounded from base to apex, the posterior angles broadly rounded. Elytral sculpture somewhat variable but much more irregular than in *punctatissimus*. Length 10.7 to 11.5 mm. Occurring on the tundra of the Western Arctic. ..... *innuitorum* n. sp.

   Pronotum with the sides moderately rounded anteriorly, feebly rounded to virtually straight on basal three-fifths; the posterior angles obtuse but well defined. Body slightly more elongate than in the other two species. Length 12.2 to 15.5 mm. Occurring from New England and Lake Superior to the northern limit of trees ..... *punctatissimus* (Randall).

Addendum to an Article "Some Nearctic Species of Hydradephagid Water Beetles, New and Old (Coleoptera)"

By HUGH B. LEECH
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Since the manuscript of the above article was submitted for publication[1] I have received from Dr. F. Guignot separates of many of his papers issued during the war years.

In "Dix-septième note sur les Hyrocanthares" (Soc. Étude Sci. Nat. Vaucluse (1942). 16-21) he cites *Hydroporus punctatissimus* Aubé as a synonym of *niger* Say, following Zimmerman (1920. Coleopterorum Cat. 71: 93), despite its placement as a synonym of *undulatus* Say in Fall's revision of 1923.

In the same paper he discusses *Heterosternus* Zimmerman and *Heterosternuta* Strand, pointing out that Falkenström (1930. Kritische Bemerkungen uber einige Dytisciden-Arten. Zool. Anzeiger 87 (1-2): 21-39) had provided a name *Sternoporus*, already placed as a synonym of *Heterosternus* (1931. Miscell. Ent. 33: 46), and thus Strand's name was not needed. Falkenström did not designate a type for *Sternoporus*, but obviously based his concept of the subgenus on *Hydroporus longicornis* Sharp.

In 1931 Guignot (loc. cit.) proposed a subgenus *Neoporus*, type *Hydroporus hebes* Fall. In 1932 (Hydrocanth. France, p. 378) he placed *longicornis* in *Neoporus*. More recently in "Dix-huitième note sur les Hydrocanthares", (Bull. Soc. Ent. France, [1945] (2): 18-22) he has put *Neoporus* as a synonym of *Sternoporus*. He thus recognizes *Sternoporus* Falkenström (for *Heterosternus* Zimmerman, nec Dupont, nec Kirsch), with *Heterosternuta* Strand and *Neoporus* Guignot as synonyms, and *Hydroporus wickhami* Zaitzev (=*concinnus* LeConte, nec Stephens) as type. Although he accepts as a type designation the discussion and illustration of *concinnus* by Zimmerman, it was not a formal citation. I hereby designate *Hydroporus concinnus* LeConte, 1855, as the generotype of *Heterosternus* Zimmerman, 1919.

In addition, as mentioned by Brinck, there is the name *Heterostethus* Falkenström, 1930 (Archiv for Zoologi, 30A (19): 8), proposed to replace *Heterosternuta* Strand, but itself a homonym of *Heterostethus* Schwarz, 1896.

[1]The present note was submitted in October, 1948, but failed to appear with the original article. See *Canad. Ent.* 80 (1-12): 89-96. Published June 9, 1949.

The Identity of *Malacosoma fragile* (Stretch) and *M. lutescens* (N. & D.) (Lepidoptera: Lasiocampidae)

By T. N. FREEMAN

A species of tent caterpillar which occurs in the prairie region of Canada, from southern Manitoba west to the foot-hills of Alberta, and which often occurs as a pest on rose, cherry, and gooseberry has been referred to as *Malacosoma fragilis* (Stretch) (properly *fragile*). In 1881, Stretch described *fragile* from Virginia City, Nevada, and an examination of Stretch's type in the American Museum of Natural History showed that this species possesses a grey ground colour and in this respect is quite unlike the fawn-coloured species from the Canadian prairie. Neumogen and Dyar, in 1893, described *lutescens* as a so-called variety of *fragile* from material collected at Miles City, Montana. An examination of the type material of this form in the United States National Museum established the identity of our Canadian prairie species. I, therefore, suggest that the latter be referred to as *Malacosoma lutescens* (N. & D.).

A New Flightless *Phaenopria* (Hymenoptera: Diapriidae)

By C. F. W. Muesebeck

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Recently I received from Dr. Clifford O. Berg a series of specimens of a diapriid reared from puparia of *Sepedon fuscipennis* Loew, a sciomyzid fly, the biology of which he has been investigating at Sodon Lake, Oakland County, Michigan. The species falls in *Phaenopria* as that genus is currently recognized, and it is apparently undescribed. At the suggestion of Dr. Berg, I am naming it in honor of Mr. Gustavus D. Pope, the owner of Sodon Lake which he has made available for research to the Cranbrook Institute of Science for a period of three years. Mr. Pope, who is a trustee of the Cranbrook Institute, has a serious interest in the research sponsored by that organization and has done a great deal to make it possible. It is, therefore, with particular pleasure that I dedicate this new species to him.

Phaenopria popei, new species

A conspicuously distinct species which is subapterous in the female sex and apterous in the male. In habitus it has a superficial resemblance to *P. aptera* Ashm., but in that species the female has no trace of wings, the thorax is stouter, and the antennae and abdominal petiole are shorter.

Female:—Length, 1.5 mm. Head subglobular, smooth and shining, slightly wider than long; face strongly convex, very broad; malar space as long as eye; temple wider than eye; antenna longer than head, thorax and abdominal petiole combined, with details as shown in illustration.

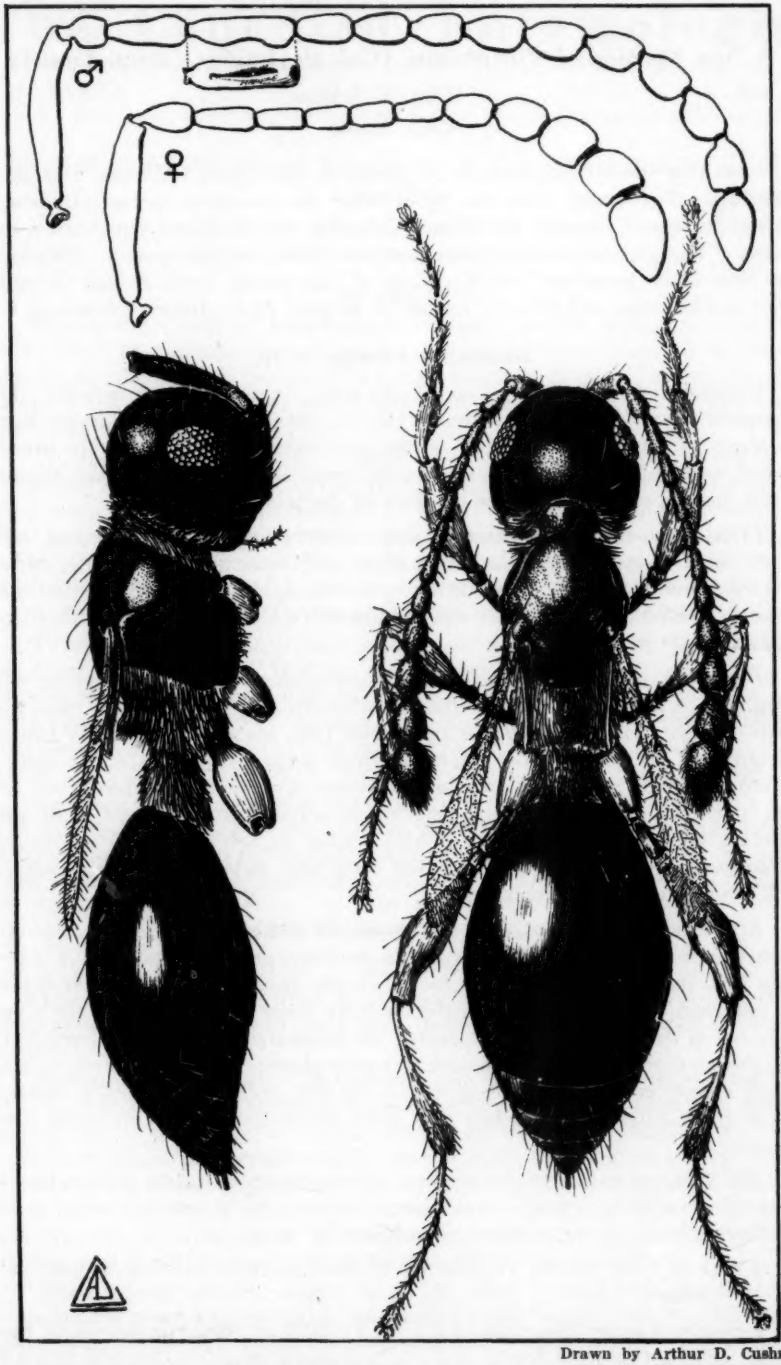
Thorax twice as long as its greatest breadth, not depressed; pronotum densely hairy, like metapleura and propodeum; mesoscutum, scutellum and mesopleura smooth and polished; scutellum separated from mesoscutum by a very delicate impressed line. Wings rudimentary but anterior wings extending more than length of abdominal petiole beyond its apex; hind wing represented by a much shorter, very slender filament; all femora thickened more or less in apical two-thirds; all tibiae thickened on apical half.

Male.—Essentially like the female, but completely apterous and with more slender 14-segmented antennae (as illustrated).

Type.—U.S. National Museum No. 59340.

Type locality.—Sodon Lake, Oakland County, Michigan.

Described from 21 females and 9 males reared July 1, 1949. Some of the paratypes have been returned to Dr. Berg.



Drawn by Arthur D. Cushman

FIG. 1—*Phaenopria popei*, new species. Lateral and dorsal views of female; antennae of male and female greatly enlarged.

A New Species of *Alniphagus* (Col. Scolytidae) from Canada

By KARL E. SCHEDL
Lienz, Austria

Checking some North American genera of bark-beetles I found a series of *Alniphagus* Sw. which does not agree with the common species *Alniphagus aspericollis* from California and British Columbia and doubtless represents a new species. The genus therefore comprises now three distinct species, *Alniphagus alni* Nijs. from Japan and the Far East, *A. aspericollis* from British Columbia down to California and the new species *A. hirsutus* from *Alnus sitchensis* in B.C.

***Alniphagus hirsutus* n. sp.**

Reddish to dark brown, 2.5 to 3.2 mm long, 2.1 times as long as wide. Distinguished from *Alniphagus aspericollis* Lec. by the smaller size, the stouter shape, the more narrowly rounded apex of the pronotum, the comparatively broadly curved apical margin of the elytra, the inconspicuous granules on the alternate elytral interstices and the longer vestiture of the whole beetle.

Front plano-convex, subshining, with a slightly impressed arcuate line in the middle and traces of a median carina above and sometimes also below, surface minutely punctulate and rather densely punctured, the punctures smaller, more remotely placed and on a more shining ground sculpture in the middle below, pubescence short and sparse.

Pronotum much wider than long, postero-lateral angles rectangular, sides subparallel on the basal two-fifths, thence rather abruptly and obliquely narrowed, much more so than in *Alniphagus aspericollis* Lec., apex but moderately broadly rounded and armed with low blunt asperities, some larger ones at the sides at the antero-lateral angles, the anterior transverse depression well developed, here with remotely placed small and pointed asperities, between them with some minute granules, basal area more shining, rather densely and finely punctured, pubescence consisting of slender rather long and inclined yellowish scale-like hairs. Scutellum small, depressed.

Elytra distinctly wider than the pronotum and about 1.4 times as long as wide, widest at the commencement of the declivity, general shape as in *A. aspericollis* Lec. but the apex distinctly more broadly rounded, the extension beyond the subapical constriction shorter, the declivity more steeply convex, the elytral striae not as deep, the punctures smaller, the alternate interstices less convex, the granules on them from inconspicuous to nearly absent, the inclined ground scales on all interstices much longer, especially on the declivity, the more remotely placed erect scales of the median row much more distinct than its much larger relative.

The frontal characters given above apparently apply to the male while the front of the female is much more evenly convex, the punctation more evenly distributed, traces of the median carina absent or nearly so.

Types in Coll. Schedl, a paratype in the Canadian National Collection in Ottawa.

Locality: Copper Mountains B.C., 22. V. 1929, ex *Alnus sitchensis*, G. Stace Smith Coll.